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Wild Sunflower From Many Locations Grown in a Uniform Environment

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Abstract

Beard, B.H. 1982. Wild Sunflower From Many Locations Grown in a Uniform Environment. U.S. Department of Agriculture. Miscellaneous Publication No. 1421, 19 p.

Wild sunflower (*Helianthus annuus* L.) seeds, collected from 246 locations in the United States and Mexico, were planted in a field at the California Agricultural Experiment Station, Davis, to determine whether phenotypic differences known to exist at the different collection sites were expressed in a uniform environment.

Individual plant measurements were made on the primary stem and capitulum (head) on 10 or fewer plants per accession. Date of anthesis (flowering) varied from May 12 to August 10, and stem length ranged from 53 to 303 cm for different accessions. Oil concentrations of the seeds were low (18.5 to 34.5 percent), but the fatty acid composition of the oil was similar to that of domestic plants in the same environment.

KEYWORDS: *Helianthus annuus* L., phenotypic variation, morphological measurements, agronomic measurements, wild species.

Issued September 1982

Wild Sunflower From Many Locations Grown in a Uniform Environment

Benjamin H. Beard[1]

Introduction

The common wild sunflower (*Helianthus annuus* L.) is widely distributed throughout the North American continent.[2] The spread of this plant by man and occasional hybridization with the domestic type and with other species probably account for much of its variability. Environmental modification of the phenotype of the crop plant is well known.[3] The plant breeder looking for new characters must always question how many accessions are needed to adequately screen the species. The plants in different localities are frequently very different in height, date of anthesis (flowering), and other characteristics, but plant breeders need to know whether these differences reflect genetic effects or environmental modifications. One way to obtain information to answer this question is to grow a number of accessions in a uniform environment and determine if there are significant differences among accessions.

The means for individual plant measurements for date of anthesis, primary stem length, primary head diameter, and other characteristics for each accession (as well as data from open-pollinated seed from the whole plot of each accession) are reported here to show the variation available in this part of our collection.

Materials and Methods

Seeds from 246 accessions of wild *H. annuus* were planted in December in Yolo silty loam soil at the California Agricultural Experiment Station, Davis, Calif. The State or country where each accession was collected is shown in table 1.

Seedling vigor was rated on a scale of 1 (small, not vigorous) to 5 (large, vigorous) when plants were at the true leaf stage. Seed length and width were determined from measurements of 10 seeds, weight of 200 seeds, and seed oil concentration from a 40-ml sample of the open-pollinated seed from any of the heads in a row. Fatty acid composition of the oil was obtained from a 25-seed subsample. Anthesis (pollen shed of first florets), head diameter, ray number, ray length, ray width, phyllary length, phyllary width, and stem length were determined from the primary stem on 10 or fewer individual plants in each accession.

Results

Plants emerged in most rows during the latter part of February, and emergence continued until the last of March. Six accessions failed to germinate. The number of plants in the other accessions ranged from 1 to over 25.

Mean seed length (table 1, p. 3) indicated all accessions were within the range (3.0 to 15.0 mm) reported by Heiser et al.[4] for this species. Oil concentration was very low compared with crop-type seeds, but fatty acid composition of the oil was similar to domestic plants grown in the same environment.

The earliest date for beginning of anthesis, May 7, was in accession No. 7 collected near Cheyenne, Wyo. The next accession to begin anthesis, No. 137, was collected in Sacramento Delta near Antioch, Calif. The mean date of anthesis for the latest accession, No. 162, was August 10 (table 2, p. 11). Individual plants were earlier and later than the mean shown here. Mature head diameter means ranged from 1.8 to 7.3 cm. Mean stem length ranged from 53 to 303 cm. These measurements were within the range given by Heiser et al.[4]

The terminal capitulum (head) of the primary stem was always first to begin anthesis.The terminal capitulum on secondary stems from the base of the plant was usually next, but tertiary capitulums on the primary stem sometimes bloomed before the secondary branches.

Discussion

Since about 1970, breeders have shown intense interest in the use of wild species to improve the domestic sunflower germplasm. With *H. annuus* so widespread, it is easy to collect many accessions from different locations, but this large number of accessions is difficult to evaluate. The final value of any accession to the plant breeder is its performance as a parent in domestic-by-wild crosses. Since over 400 wild *H. annuus* accessions are available in our collection, it is practically impossible to evaluate hybrid progeny from all the parental combinations that might be developed. A reasonable alternative might be to obtain morphologic and agro-

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[2]Heiser, C.B., Jr., D.M. Smith, S.B. Clevenger, and W.C. Martin, Jr. 1969. The North American sunflowers (*Helianthus*). Memoirs of the Torrey Botanical Club 22:1-218.

[3]Goyne, P.J., B.W. Simpson, D.R. Woodruff, and J.D. Churchett. 1979. Environmental influences on sunflower achene growth, soil concentration, and quality. Australian Journal of Experimental Agriculture and Animal Husbandry 19:82-88.

[4]See footnote 2.

nomic data in a uniform environment to determine which accessions will have the highest probability of contributing something useful to each objective in a breeding program.

Measurements of anthesis date or stem length will probably indicate whether this accession will tend to make the progeny earlier or later and tall or short. On the other hand, measurements of oil content and fatty composition of the oil (both extremely sensitive to environmental influence) and seed size, (which is so much smaller than the crop-type seed) may not help in determining the segregation limits of the progeny.

Since usefulness of the data reported here will partially depend on the objective of the user, the data are presented in detail to allow the plant breeder to form some idea of which accessions might be of most benefit to accomplish his or her particular objectives. Seed of these accessions, however, is limited and may not always be available. These data will also indicate the range of different characters that may be found in the *Helianthus* Germplasm Pool IV recently released by the author.[5]

Determination of earliness of a wild *H. annuus* plant should be from some easily distinguished criteria and should be uniform from plant to plant. In this study, anthesis date was determined from the capitulum of the primary head. Recording data from a capitulum on a branch are less accurate because of variation from plant to plant. Most if not all plants of wild species will continue to flower for weeks or even months unless stopped by the environment.

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[5]Beard, B.H. 1981. Notice of release of *Helianthus* Germplasm Pool IV. USDA, ARS, and University of California, Davis. [Unpublished.]

Table 1. Seedling visor ratings, seed length, seed width, 200 seed weight, oil content, and fatty acid composition of the oil from open-pollinated seed of the first 246 accessions in the USDA Helianthus annuus L. collection at Davis, Calif., and State or country, latitude, longitude, and elevation of collection site

HSF07	Visor	Seed			Oil								
No.1/	Rating2/	Length mm	Width mm	200 wt. g	Oil %	C16:0 %	C18:0 %	C18:1 %	C18:2 %	State3/	Lat.N	Long.W	Code4/
1	4	5.4	2.8	1.8	29.2	3.8	7.1	18.0	70.9	MO	38:37	090:11	1
3	3	5.0	2.2	1.4	29.5	3.2	5.3	19.8	71.7	SD	44:03	098:16	1
4	3	5.5	2.8	2.6	28.9	2.5	6.1	18.9	72.5	SD	43:43	097:35	1
5	3	4.5	2.2	1.4	31.7	3.6	6.6	19.4	70.2	NE	42:56	101:14	3
6	2	4.8	2.5	1.2	25.7	3.1	6.6	18.1	72.2	WY	44:41	104:26	5
7	3	5.8	2.8	2.5	31.4	2.2	6.5	24.9	66.5	WY	43:50	104:11	4
8	3	4.5	2.7	1.5	30.0	2.2	6.9	20.4	70.7	WY	42:45	098:01	1
9	3	4.9	2.6	1.9	30.4	2.6	3.6	18.1	75.7	WY	42:44	105:00	5
10	3	4.7	2.6	1.9	30.4	3.1	5.2	21.9	69.8	WY	41:47	104:15	4
11	3	5.6	2.5	1.6	30.0	2.6	4.0	20.6	72.8	WY	42:47	110:56	6
12	4	4.6	2.2	1.4	29.8	2.2	4.8	22.5	70.3	CO	39:44	103:35	5
13	4	4.6	2.4	1.5	29.7	1.3	5.3	22.7	70.5	CO	39:15	103:41	5
14	3	4.8	2.4	1.3	30.8	3.1	7.4	23.7	65.8	CO	38:49	103:00	4
15	2	4.8	2.5	1.7	29.1	2.8	5.8	23.7	67.8	CO	40:05	105:56	4
16	2	4.7	2.7	1.4	32.5	3.5	5.1	26.7	64.8	KS	37:58	101:45	3
17	2	4.5	2.6	1.7	30.0	3.1	6.0	19.7	71.2	KS	37:58	100:52	3
18	3	4.3	2.4	1.5	31.9	2.6	7.5	21.4	68.5	KS	38:20	098:12	2
19	4	6.3	3.0	3.3	34.2	2.6	6.7	25.8	65.0	KS	39:02	098:08	1
22	4	5.2	2.6	1.7	31.1	2.5	7.1	22.9	67.5	NE	40:35	098:23	2
23	3	5.1	2.6	2.3	33.1	2.4	7.8	21.9	67.8	NE	40:41	099:05	2
24	3	4.4	2.3	1.3	30.4	2.0	5.5	19.1	73.5	NE	42:52	100:32	2
25	3	5.0	2.5	1.8	29.7	2.1	5.6	22.1	70.2	SD	43:53	100:43	2
26	3	5.0	2.1	1.5	29.0	2.9	4.6	22.1	70.4	SD	45:00	099:57	2
27	4	5.5	2.4	1.8	31.3	2.3	3.7	21.3	72.8	ND	46:01	099:58	2
28	3	5.0	3.0	2.0	30.5	2.0	3.0	20.8	71.3	ND	46:35	097:29	1
29	2	4.6	2.4	1.3	32.0	2.6	4.9	22.8	69.7	ND	46:12	097:57	1

Table 1. Seedling vigor ratings, seed length, seed width, 200 seed weight, oil content, and fatty acid composition of the oil from open-pollinated seed of the first 246 accessions in the USDA Helianthus annuus L. collection at Davis, Calif., and State or country, latitude, longitude, and elevation of collection site--Continued

HSP07 No.1/	Vigor Rating2/	Seed Length mm	Seed Width mm	Seed 200 wt. g	Seed Oil %	Oil C16:0 %	Oil C18:0 %	Oil C18:1 %	Oil C18:2 %	State3/	Lat.N	Long.W	Code4/
30	2	4.4	2.2	1.5	31.5	2.0	7.4	22.4	68.0	CA	37:07	118:27	4
31	2	4.6	2.4	1.3	30.2	3.6	6.1	20.2	70.1	CA	38:20	121:34	0
32	1	4.4	2.0	1.2	27.0	2.8	6.3	22.1	68.7	CA	36:43	119:47	0
33	1	4.4	2.3	1.6	27.0	3.5	6.4	23.3	66.8	CA	37:15	120:59	0
36	4	5.4	2.5	2.2	31.1	3.2	5.0	27.3	64.5	CA	35:07	118:27	4
37	2	5.1	2.0	1.4	28.5	3.2	7.1	19.3	70.3	CA	34:53	117:01	2
39	4	5.1	2.7	1.8	26.9	2.9	6.2	23.0	67.9	CA	35:00	117:39	2
46	2	4.8	2.6	1.6	30.3	3.1	5.8	24.3	66.8	CA	38:00	121:48	0
49	4	4.9	2.5	1.2	24.4	3.5	6.4	21.6	68.5	CA	38:00	122:00	0
50	5	6.1	3.5	2.9	33.2	3.1	6.9	22.5	67.7	CA	37:57	121:17	0
51	2	4.5	2.4	1.3	28.3	3.5	7.8	22.0	66.7	MX	26:45	109:48	0
52	3	4.8	2.7	1.5	27.1	3.5	6.8	23.3	66.3	MX	26:45	109:48	0
53	2	4.8	2.1	1.2	31.7	3.3	7.0	22.7	67.0	MX	26:45	109:48	0
55	4	5.1	2.8	1.9	31.0	3.5	5.7	23.6	71.1	CA	38:32	121:44	0
56	4	5.6	2.6	2.2	28.6	3.0	6.2	22.1	68.6	CA	38:32	121:44	0
57	3	4.8	2.4	1.7	30.6	2.3	7.1	21.3	69.2	CA	38:32	121:44	0
58	3	5.6	2.6	2.0	25.3	3.4	5.9	19.8	70.9	CA	37:29	120:50	0
59	3	5.3	2.7	2.2	28.9	2.9	7.8	21.7	67.6	CA	37:29	120:50	0
61	3	6.0	2.9	2.2	34.5	2.8	7.9	19.5	69.7	CA	38:20	121:34	0
62	3	4.5	2.4	1.3	32.0	2.6	7.4	19.9	70.1	CA	36:43	119:47	0
63	3	4.4	2.3	1.4	29.0	2.6	7.6	21.8	67.9	CA	37:15	120:59	0
64	3	4.6	2.1	1.2	30.3	3.0	7.7	19.6	69.7	CA	32:48	115:22	0
65	3	5.3	3.0	1.9	31.5	2.4	6.9	20.3	70.4	CA	32:48	115:22	0
66	3	5.4	2.7	1.7	31.8	3.2	6.5	20.4	69.9	CA	32:42	114:37	0
67	3	4.6	2.2	1.4	30.3	3.1	7.2	23.4	66.4	CA	32:42	114:37	0

68	3	5.2	3.0	2.0	32.7	2.7	6.9	22.0	68.3	CA	34:53	117:01	2
71	4	4.8	2.8	1.9	32.8	2.4	6.4	23.2	68.0	CA	34:53	117:01	2
72	4	4.6	2.7	2.0	28.5	2.6	7.0	22.4	67.9	CA	34:53	117:01	2
73	4	4.2	2.1	1.4	28.1	3.1	7.7	21.5	67.7	CA	34:53	117:01	2
74	3	4.9	2.4	1.2	29.2	3.3	7.9	19.4	69.3	CA	34:53	117:01	2
75	3	4.6	2.6	1.4	26.5	3.2	7.2	20.7	68.9	CA	34:53	117:01	2
76	4	5.5	3.2	2.9	30.2	2.4	7.1	20.5	63.1	CA	35:00	117:39	2
77	5	5.4	3.0	2.4	30.5	2.3	7.2	24.6	65.9	CA	35:00	117:39	2
78	4	4.7	2.8	2.2	29.6	2.0	7.1	28.3	62.6	CA	35:00	117:39	2
79	4	5.0	2.9	2.3	27.3	2.3	7.1	27.7	62.9	CA	35:00	117:39	2
80	4	5.2	3.0	2.3	30.1	2.4	6.5	27.0	64.1	CA	35:00	117:39	2
81	4	4.8	2.7	2.0	28.2	2.6	7.1	27.0	63.4	CA	35:00	117:39	2
82	3	4.9	3.1	1.8	31.2	2.0	7.6	26.0	64.3	CA	35:03	118:10	3
84	3	4.8	2.8	1.8	29.9	2.6	6.7	24.3	66.3	CA	35:03	118:10	3
86	3	5.3	3.2	2.4	30.1	2.1	7.4	21.5	68.9	CA	36:31	120:06	0
87	2	4.3	2.7	2.1	31.2	2.7	5.9	21.4	70.0	CA	37:03	120:50	0
88	3	4.4	2.3	1.4	30.8	2.5	6.9	25.3	67.3	CA	38:00	121:48	0
89	4	5.6	2.7	2.0	28.1	2.7	7.2	20.8	69.3	CA	38:00	122:00	0
90	4	5.2	2.6	2.3	27.6	2.6	7.1	18.7	71.4	CA	38:00	122:00	0
91	2	4.9	2.7	2.1	27.6	3.3	7.1	23.8	65.7	CA	38:00	122:00	0
93	3	4.9	2.1	1.4	30.0	2.9	7.1	21.8	68.2	CA	38:00	122:00	0
94	3	4.8	2.6	1.7	26.3	2.5	7.4	21.1	69.0	CA	38:00	122:00	0
95	4	5.0	2.4	1.9	28.1	2.7	7.3	21.2	68.8	CA	38:00	122:00	0
96	3	4.9	2.5	1.4	29.1	2.8	6.8	22.5	67.9	CA	38:00	122:00	0
97	1	5.0	2.7	2.2	27.5	2.8	6.6	22.7	67.9	CA	38:00	122:00	0
98	4	5.4	2.7	1.8	28.9	3.2	6.6	20.5	69.7	CA	38:00	122:00	0
99	1	5.2	2.6	1.8	26.5	3.3	7.4	22.4	67.0	CA	38:00	122:00	0
100	1	4.9	2.6	1.8	27.6	3.0	7.5	18.6	70.8	CA	38:00	122:00	0
101	1	4.9	2.6	1.8	26.1	3.2	7.5	20.7	68.6	CA	38:00	122:00	0
102	1	4.9	2.3	2.8	27.2	2.9	6.9	24.5	65.7	CA	38:00	122:00	0

Table 1. Seedling vigor ratings, seed length, seed width, 200 seed weight, oil content, and fatty acid composition of the oil from open-pollinated seed of the first 246 accessions in the USDA Helianthus annuus L. collection at Davis, Calif., and State or country, latitude, longitude, and elevation of collection site--Continued

HSP07	Vigor	Seed				Oil							
No.1/	Rating2/	Length mm	Width mm	200 wt. g	Oil %	C16:0 %	C18:0 %	C18:1 %	C18:2 %	State3/	Lat.N	Long.W	Code4/
103	2	4.6	2.2	1.4	27.5	3.0	8.1	18.2	70.7	CA	38:10	121:40	0
104	2	4.5	2.7	1.1	25.3	3.2	7.8	19.5	69.5	CA	38:10	121:40	0
105	1	4.7	2.6	1.5	26.1	2.9	7.4	19.1	70.5	CA	38:10	121:40	0
107	1	4.3	2.4	1.4	29.8	3.8	6.8	22.2	67.1	MX	26:45	109:47	0
108	1	4.8	2.7	1.4	28.6	2.8	7.1	23.7	66.5	MX	26:45	109:47	0
109	3	4.0	2.0	1.0	27.0	3.1	6.8	21.3	68.8	MX	26:45	109:47	0
110	2	4.9	2.7	1.6	28.7	3.0	7.2	24.2	65.6	MX	26:45	109:47	0
111	2	5.1	2.7	1.8	33.6	3.4	5.6	24.9	66.1	MX	22:47	103:31	2
112	3	5.3	3.1	2.6	26.8	3.0	6.7	21.8	68.5	CA	38:40	121:46	0
113	4	6.3	3.9	4.4	29.0	3.5	5.9	24.3	66.3	CA	38:40	121:46	0
114	3	6.3	3.2	4.3	30.2	3.0	6.2	24.7	66.1	CA	38:40	121:46	0
115	3	6.3	3.3	4.5	31.3	2.8	6.1	19.8	71.3	CA	38:40	121:46	0
116	3	5.9	3.2	3.5	30.6	2.1	5.9	22.0	70.0	CA	38:40	121:46	0
117	3	6.1	3.7	4.5	28.1	3.2	6.3	21.3	69.1	CA	38:40	121:46	0
118	4	6.1	3.9	3.9	29.6	2.7	6.5	29.4	61.3	CA	38:40	121:46	0
119	4	6.8	3.6	3.9	29.2	2.1	6.4	25.8	65.7	CA	38:40	121:46	0
120	4	4.2	2.3	1.9	28.9	2.7	6.0	21.2	70.2	CA	38:40	121:46	0
121	3	4.6	3.0	2.6	28.9	2.2	6.1	24.0	67.8	CA	38:40	121:46	0
122	5	5.6	3.0	2.0	28.1	2.5	6.4	21.6	69.5	CA	38:40	121:46	0
123	5	4.9	2.6	2.2	27.1	2.3	6.4	22.2	69.2	CA	38:40	121:46	0
124	4	5.8	3.0	1.3	28.4	3.1	6.4	24.6	65.9	CA	38:40	121:46	0
125	2	5.0	2.2	1.4	33.6	2.2	6.9	19.8	71.1	CA	38:32	121:44	0
126	2	5.3	2.6	2.2	31.5	2.6	7.0	23.7	66.7	CA	38:32	121:44	0
127	2	4.6	2.4	1.7	29.3	2.8	6.6	23.1	67.6	CA	38:32	121:44	0
128	1	5.1	2.8	2.0	27.2	2.5	6.2	24.2	67.0	CA	38:35	121:29	0
129	3	5.0	2.7	1.9	28.2	2.5	6.7	23.0	67.8	CA	38:35	121:29	0

130	2	4.5	2.5	1.5	31.4	2.3	6.8	21.5	69.4	CA	38:35	121:29	0
131	3	5.3	2.6	2.0	29.4	2.6	6.8	21.6	68.7	CA	38:35	121:29	0
132	3	5.7	2.9	2.3	28.4	2.5	7.2	22.3	67.9	CA	38:35	121:29	0
133	3	5.1	2.8	2.1	26.8	2.3	6.7	23.1	67.8	CA	38:35	121:29	0
134	3	4.3	2.1	1.2	29.5	2.1	7.3	22.0	68.6	CA	38:32	121:44	0
135	3	5.3	2.4	1.5	27.9	2.6	6.0	20.2	71.3	CA	38:32	121:44	0
136	2	4.8	2.6	1.6	29.8	2.7	7.1	23.0	67.1	CA	36:20	119:17	0
137	3	4.6	2.4	1.8	25.7	3.9	5.5	26.2	64.4	CA	37:47	120:59	0
141	2	4.1	2.0	1.1	28.6	2.3	7.2	20.7	69.8	AZ	31:57	110:17	4
142	2	4.5	2.0	1.1	27.2	2.4	7.0	19.1	71.5	AZ	35:11	111:39	7
143	3	4.0	2.0	0.8	26.5	2.4	7.4	18.0	72.2	AZ	35:11	111:39	7
145	2	4.6	2.1	1.5	30.2	2.0	6.3	24.6	67.0	NM	32:20	108:42	4
146	2	4.6	2.6	1.4	29.7	2.7	6.0	22.9	68.4	NM	32:20	108:42	4
147	3	5.3	1.9	1.1	27.4	2.5	7.5	21.5	68.6	TX	32:18	106:46	4
148	2	4.5	1.9	1.1	27.4	2.5	7.5	21.5	68.6	TX	31:02	104:49	4
149	2	4.0	2.6	1.6	27.7	3.1	6.2	21.1	69.6	TX	31:04	104:13	4
150	2	4.5	2.4	1.4	29.0	3.2	6.4	22.1	68.4	TX	30:59	103:44	3
151	2	4.0	2.6	1.4	29.5	2.5	7.9	21.8	66.7	TX	30:59	103:44	3
152	3	4.2	2.0	1.4	28.0	3.1	5.9	19.4	71.6	TX	30:59	103:44	3
153	2	4.0	2.0	1.0	29.5	3.5	5.9	24.3	66.4	TX	30:59	103:44	3
154	2	4.0	2.0	1.3	29.2	3.0	6.3	20.9	69.8	TX	30:53	102:53	3
155	2	3.8	2.2	1.5	30.1	3.1	6.7	21.1	69.2	TX	30:53	102:53	3
156	2	4.1	2.1	1.1	28.8	3.3	6.7	15.8	74.2	TX	30:34	100:38	2
158	1	3.5	2.0	0.8	29.6	3.1	8.0	18.8	70.2	TX	30:04	099:14	2
159	2	4.6	2.7	1.9	28.0	3.1	7.3	16.7	72.9	TX	29:34	097:58	1
160	1	5.9	2.8	2.4	34.4	2.5	6.7	21.4	69.2	TX	30:36	096:20	0
163	2	4.3	2.4	1.2	23.5	2.7	7.3	19.8	70.2	KS	37:06	097:20	1
164	3	4.0	2.2	1.4	24.8	2.7	6.9	20.5	70.0	AZ	35:19	112:52	5
165	3	3.8	2.1	1.0	29.8	3.1	5.6	20.9	70.4	UT	38:56	114:01	6

Table 1. Seedling vigor ratings, seed length, seed width, 200 seed weight, oil content, and fatty acid composition of the oil from open-pollinated seed of the first 246 accessions in the USDA Helianthus annuus L. collection at Davis, Calif., and State or country, latitude, longitude, and elevation of collection site--Continued

HSP07	Vigor	Seed				Oil							
No.1/	Rating2/	Length mm	Width mm	200 wt. g	Oil %	C16:0 %	C18:0 %	C18:1 %	C18:2 %	State3/	Lat.N	Long.W	Code4/
166	3	4.8	2.7	1.5	30.8	3.0	6.2	21.9	68.9	NV	39:30	115:57	6
167	2	4.4	2.3	1.3	30.4	4.0	6.1	23.5	66.4	UT	38:23	113:00	5
168	2	4.5	2.6	1.6	31.3	3.0	6.1	19.8	71.1	UT	40:45	111:52	4
169	2	4.8	2.7	1.7	30.9	3.3	5.8	23.2	67.7	CA	38:48	121:43	0
170	1	4.0	2.3	1.5	26.1	2.8	5.8	25.6	65.7	CA	38:48	121:43	0
171	3	4.6	2.4	1.3	31.2	2.8	6.4	22.6	68.2	CA	38:48	121:43	0
172	2	5.4	2.6	1.8	28.6	2.9	6.0	21.9	69.2	CA	38:48	121:43	0
174	3	4.5	2.2	1.3	27.1	3.2	6.3	23.2	67.3	CA	38:48	121:43	0
175	2	4.4	2.6	1.2	28.1	2.4	8.0	22.8	68.5	CA	39:04	121:53	0
177	3	4.2	2.2	1.1	31.3	3.2	5.7	23.1	68.1	NM	NA	NA	NA
178	2	3.9	2.2	1.3	31.5	2.3	6.7	20.4	70.7	UT	NA	NA	NA
179	3	4.8	2.6	1.6	29.4	2.4	5.6	23.0	69.0	UT	NA	NA	NA
180	1	5.7	2.6	1.6	32.6	2.9	6.3	24.4	66.4	NA	NA	NA	NA
181	2	4.5	2.4	1.3	30.3	2.2	5.7	20.6	71.5	NA	NA	NA	NA
182	3	4.9	2.7	1.2	32.4	2.9	6.0	19.5	71.7	NA	NA	NA	NA
183	3	4.4	2.5	1.1	30.0	3.3	5.7	20.8	70.3	NA	NA	NA	NA
184	3	3.9	2.6	1.2	27.8	3.0	6.5	20.0	70.6	NA	NA	NA	NA
185	1	4.3	2.7	1.7	24.8	3.0	6.6	19.2	71.2	NA	NA	NA	NA
187	2	4.4	2.3	1.1	28.3	3.1	5.7	20.8	70.4	NA	NA	NA	NA
188	1	4.5	2.3	1.2	28.6	3.3	6.2	20.3	70.2	NA	NA	NA	NA
189	2	4.8	2.5	1.4	29.0	3.2	5.6	19.3	72.0	NA	NA	NA	NA
190	2	4.9	2.7	1.4	27.1	3.4	6.2	20.2	70.2	NA	NA	NA	NA
191	1	4.4	2.4	1.5	30.7	3.1	6.2	22.7	68.1	NA	NA	NA	NA
192	1	4.6	2.4	1.5	28.5	3.3	6.2	21.2	69.3	NA	NA	NA	NA
193	2	5.0	2.4	1.7	28.4	3.4	6.6	20.9	69.1	CA	38:35	121:29	0
195	2	4.8	2.7	1.5	28.0	2.3	6.4	22.2	69.1	CA	32:58	115:31	0

196	2	5.0	2.6	1.3	28.0	3.5	6.1	27.6	62.8	CA	32:47	115:33	0
197	2	4.8	2.4	1.0	25.1	3.1	5.6	28.1	63.3	CA	32:58	115:31	0
198	2	4.8	2.4	1.3	30.6	2.7	6.4	20.8	70.1	CA	32:47	115:33	0
199	3	4.3	2.3	1.2	24.4	3.3	7.3	25.7	63.7	CA	32:58	115:31	0
200	3	4.3	2.3	1.3	31.6	2.7	6.2	21.9	69.3	CA	32:58	115:31	0
202	2	4.1	2.2	0.8	18.5	4.2	7.2	29.4	59.2	CA	33:44	116:58	1
203	3	4.2	2.1	1.2	28.7	2.8	6.8	26.5	64.0	CA	33:58	117:21	1
204	1	4.4	2.4	1.1	25.0	3.7	5.4	27.4	63.0	CA	33:45	117:10	1
205	1	3.6	2.0	1.4	27.0	3.0	8.1	20.9	68.0	CA	33:17	116:38	3
206	1	4.1	2.0	0.9	27.0	2.9	5.6	23.5	68.0	CA	33:26	116:51	4
207	2	4.1	2.5	0.9	26.0	3.8	6.3	27.4	62.5	CA	33:58	117:21	1
208	2	4.7	2.3	1.3	25.7	3.4	5.1	25.6	65.9	CA	33:44	116:58	1
209	2	4.8	2.7	1.4	30.5	3.2	5.4	21.4	59.9	CA	34:47	118:51	4
210	2	4.1	2.0	1.0	26.7	2.7	6.9	23.2	67.3	CA	32:36	116:28	3
211	1	3.8	2.1	0.8	30.3	3.2	6.1	24.7	66.0	CA	33:06	116:40	3
212	2	3.9	2.0	1.1	27.9	2.9	5.6	21.6	69.6	CA	33:29	117:08	2
213	2	3.6	2.1	0.8	29.3	3.4	8.0	18.7	71.9	CA	33:44	116:58	1
214	2	4.3	2.1	1.2	28.3	3.3	6.3	22.0	68.3	CA	34:06	117:18	2
215	1	4.3	2.2	1.1	28.9	3.7	6.2	21.0	69.1	CA	35:22	119:01	0
216	1	4.2	2.4	1.3	27.9	3.6	6.3	20.1	70.0	CA	34:47	118:51	4
217	1	4.6	2.7	1.2	25.4	4.0	5.6	25.2	65.2	CA	34:47	118:51	4
218	3	4.7	2.6	1.6	28.2	3.1	5.8	22.1	69.0	CA	34:54	118:52	4
219	1	4.6	2.7	1.6	32.8	2.9	6.3	19.2	71.7	CA	34:54	118:52	4
220	2	4.1	2.0	0.8	32.1	2.8	5.7	20.1	71.4	CA	37:09	118:17	4
221	2	3.7	2.1	0.9	30.1	2.9	6.7	18.8	71.6	CA	37:21	118:23	4
222	2	4.2	1.9	0.9	31.6	2.5	3.3	16.6	77.6	CA	36:48	118:12	4
223	2	4.5	2.3	1.0	33.1	3.0	5.2	20.5	71.6	CA	36:36	118:03	4
224	2	5.8	3.1	2.7	30.2	3.0	7.4	22.5	67.0	CA	41:15	122:08	3
225	1	5.1	2.8	2.0	30.6	3.3	5.2	21.1	70.5	CA	41:15	122:08	3

Table 1. Seedling vigor rating, seed length, seed width, 200 seed weight, oil content, and fatty acid composition of the oil from open-pollinated seed of the first 246 accessions in the USDA Helianthus annuus L. collection at Davis, Calif., and State or country, latitude, longitude, and elevation of collection site--Continued

HSF07	Vigor	Seed				Oil							
No.1/	Rating2/	Length mm	Width mm	200 wt. g	Oil %	C16:0 %	C18:0 %	C18:1 %	C18:2 %	State3/	Lat.N	Long.W	Code4/
226	3	4.4	2.2	1.4	29.3	2.5	6.2	21.3	70.0	CA	40:52	121:40	3
227	2	5.8	2.9	2.5	33.5	2.7	5.5	23.9	68.0	CA	41:12	121:09	4
228	2	5.4	2.6	2.2	28.2	2.6	5.3	23.0	69.1	CA	40:35	122:29	3
229	1	4.8	2.7	1.4	27.6	2.7	5.4	22.0	69.9	CA	40:52	121:40	3
230	1	4.7	2.2	1.5	28.4	3.5	5.1	22.2	69.2	CA	40:44	122:04	1
231	3	4.4	2.7	1.2	19.2	4.4	7.2	26.1	62.4	CA	40:52	121:40	3
232	3	3.5	2.0	0.8	23.6	4.3	8.0	15.6	72.1	CA	40:52	121:40	3
236	1	3.1	1.9	0.6	27.0	3.7	9.7	16.4	70.2	CA	33:15	116:22	1
237	2	4.3	2.2	0.8	19.0	4.0	7.3	30.3	58.4	CA	33:15	116:22	1
238	3	4.5	2.5	1.3	28.0	2.4	5.3	23.3	69.1	CA	32:39	116:15	4
239	2	4.5	2.8	1.1	25.6	3.4	6.4	28.5	61.7	CA	33:25	114:44	0
240	2	4.5	2.5	1.2	25.5	3.8	7.0	29.4	59.8	CA	33:25	114:44	0
241	2	4.9	2.4	1.5	29.5	2.3	5.9	18.9	72.9	CA	32:02	115:37	0
242	3	5.4	2.7	1.9	30.1	2.1	5.2	23.1	69.5	CA	NA	NA	NA
243	2	6.3	2.8	2.2	27.0	2.6	5.5	21.8	70.2	CA	NA	NA	NA
244	2	5.2	2.4	1.9	30.6	2.7	5.2	21.1	71.0	CA	NA	NA	NA
245	3	4.5	2.4	1.4	30.1	2.7	6.4	19.1	71.8	CA	36:48	118:12	4
246	2	4.4	2.3	1.2	28.9	4.1	7.6	15.1	73.2	CA	39:09	121:45	0

1 HSF07 = Helianthus species, 07, the number for annuus, see Heiser et al. (1969).

2 Seedling vigor rating: 1 = poor, 5 = vigorous.

3 U.S. Postal Service state abbreviations plus MX=Mexico and NA=not available.

4 Code for elevation: 0 =less than 1,000 ft, 1, 2, etc. 1,000, 2,000, ft. etc.

Table 2. Number of plants measured in each accession, date of anthesis, head diameter at maturity, ray number, ray length, ray width, phyllary length, phyllary width of the primary capitulum, and length of the primary stem of the first 246 accessions in the USDA Helianthus annuus L. collection at Davis, Calif.

HSF07 No.		Primary Head				Rays						Phyllaries				Stem	
No.	Plts	Anthesis		Diameter		Number		Length		Width		Length		Width		Length	
		Mo	Day	cm1				cm1		cm1		cm1		cm1		cm1	
1	7	6	11	3.6	0.9	27	1.4	3.6	0.9	1.1	0.3	1.8	0.6	1.3	0.1	183	21
3	10	6	5	3.9	0.6	27	4.7	3.3	0.7	1.1	0.1	2.0	0.4	1.1	0.2	163	38
4	2	6	8	3.8	0.4	28	9.2	4.0	0.6	1.1	0.1	2.4	0.4	1.2	0.1	192	1
5	8	6	10	2.3	2.0	28	4.8	3.6	0.7	1.1	0.3	2.1	0.5	1.0	0.2	187	17
6	4	5	21	2.7	0.9	23	5.0	3.1	0.4	1.1	0.1	2.5	0.4	1.0	0.1	110	36
7	8	5	12	3.4	2.5	19	1.6	4.2	1.2	1.4	0.6	2.6	0.9	1.1	0.6	82	14
8	10	5	22	3.3	0.8	21	3.2	3.4	0.4	1.2	0.3	2.8	0.4	1.0	0.2	127	26
9	9	5	28	4.0	0.9	30	4.6	3.8	0.3	1.2	0.2	2.4	0.4	1.2	0.2	161	38
10	10	6	1	4.1	1.0	28	4.9	3.7	0.3	1.2	0.3	2.4	0.3	1.2	0.2	144	23
11	7	5	31	4.0	1.1	23	3.5	3.7	0.7	1.3	0.3	2.5	0.4	1.0	0.1	138	35
12	9	5	31	3.8	0.6	27	6.9	2.9	0.5	1.1	0.4	2.2	0.4	0.9	0.2	156	19
13	8	6	6	4.1	0.7	27	2.9	3.4	0.3	1.1	0.2	2.1	0.2	1.1	0.1	162	22
14	10	6	5	4.3	0.5	25	4.5	3.4	0.8	1.1	0.2	2.1	0.6	2.5	3.2	166	24
15	9	6	12	4.2	0.6	21	4.2	2.9	0.1	1.3	0.6	1.7	0.7	1.2	NA	165	26
16	10	6	13	4.5	0.4	28	5.4	3.5	1.2	1.0	0.3	2.4	0.5	1.1	0.1	211	31
17	10	5	26	4.3	0.6	23	3.1	3.7	0.4	1.2	0.2	2.6	0.5	1.2	0.2	141	24
18	10	6	11	4.3	0.4	24	2.6	3.7	0.5	1.0	0.2	2.4	0.8	1.2	0.3	202	23
19	9	7	16	NA		NA		NA		NA		NA		NA		196	34
20	10	6	11	4.5	0.7	24	5.1	3.8	0.4	1.0	0.2	2.4	0.3	1.1	0.2	207	23
21	7	6	12	6.5	NA	34	NA	4.9	NA	1.3	NA	2.8	NA	1.2	NA	215	24
22	8	6	11	4.7	0.3	24	3.5	4.0	1.1	1.3	0.2	1.8	0.1	1.3	0.4	229	21
23	10	6	12	4.5	0.8	25	8.1	3.6	1.1	1.2	0.2	1.8	0.3	1.2	0.1	197	26
24	10	6	1	3.9	0.5	23	4.6	3.4	0.7	1.2	0.2	1.9	0.3	1.0	0.1	150	22
25	9	5	22	2.9	1.0	20	0.8	3.6	0.6	1.3	0.3	2.5	0.3	1.0	0.1	131	28
26	10	6	4	4.5	0.6	31	4.1	3.5	0.5	1.2	0.2	2.0	0.5	1.2	0.2	177	35
27	10	6	1	4.4	0.5	22	3.8	3.8	0.6	1.3	0.2	2.8	0.4	1.3	0.2	187	34

Table 2. Number of plants measured in each accession, date of anthesis, head diameter at maturity, ray number, ray length, ray width, phyllary length, phyllary width of the primary capitulum, and length of the primary stem of the first 246 accessions in the USDA Helianthus annuus L. collection at Davis, Calif.--Continued

HSP07 No.		Anthesis		Primary Head	Rays			Phyllaries		Stem
No.	Plts	Anthesis		Diameter	Number	Length	Width	Length	Width	Length
		Mo	Day	cm1		cm1	cm1	cm1	cm1	cm1
28	10	6	13	3.8 0.3	23 6.5	3.5 0.4	1.0 0.1	2.0 0.4	1.1 0.4	182 38
29	10	6	5	4.3 0.6	33 13.8	3.7 0.5	1.3 0.3	2.2 0.5	1.1 0.2	165 36
30	10	6	9	3.8 0.4	18 2.9	3.1 0.6	1.3 0.4	2.3 0.4	1.0 0.2	165 21
31	8	6	12	4.8 0.4	28 5.0	3.7 0.7	1.5 0.3	2.7 0.9	1.2 0.3	188 19
32	9	6	7	3.4 0.4	17 3.2	2.8 0.6	1.0 0.3	2.0 0.3	0.9 0.1	165 13
33	9	6	8	3.8 0.5	17 2.5	3.4 0.6	1.2 0.3	1.9 0.5	1.1 0.2	184 30
34	8	6	7	3.5 NA	20 2.2	2.8 0.5	1.1 0.1	1.9 0.1	0.8 0.2	180 13
35	10	6	1	3.4 0.4	17 2.7	2.8 0.7	1.0 0.2	2.0 0.4	0.8 0.1	194 18
36	9	6	9	4.4 1.0	26 5.0	4.1 0.8	1.3 0.2	2.7 0.9	1.3 0.1	201 19
37	8	6	8	3.1 0.4	18 2.5	3.0 0.8	1.1 0.2	2.0 0.3	0.7 0.1	159 20
38	8	6	3	4.0 0.5	22 4.0	3.7 0.8	1.4 0.3	2.3 0.4	1.1 0.1	210 27
39	9	6	7	4.0 0.5	22 1.9	4.4 1.3	1.7 0.4	2.3 0.9	1.1 0.3	197 37
40	9	6	14	4.5 NA	22 3.0	3.5 0.9	1.3 0.4	2.0 0.4	1.0 0.2	211 11
41	10	6	10	3.7 0.3	19 4.3	3.6 0.7	1.4 0.3	2.1 0.5	1.0 0.3	201 24
42	6	6	14	3.7 0.6	18 2.4	3.4 1.2	1.3 0.4	1.9 0.2	0.9 0.1	181 18
43	6	6	5	3.7 0.3	20 0.5	3.3 0.3	1.4 0.3	2.1 0.4	0.9 0.1	190 25
44	7	6	4	4.0 NA	20 5.9	3.1 0.9	1.1 0.3	2.1 0.3	0.9 0.2	178 18
45	9	6	14	4.7 0.6	22 2.2	3.7 0.5	1.5 0.4	2.2 0.6	1.0 0.2	189 41
46	10	6	7	3.6 0.5	20 1.7	3.2 0.6	1.1 NA	2.3 0.4	1.0 0.1	190 26
47	7	6	5	4.2 0.4	18 1.8	3.1 0.5	1.3 0.2	2.0 0.4	0.8 0.2	165 31
48	10	6	7	3.9 0.6	18 3.5	3.4 0.3	1.3 0.5	2.0 0.2	1.0 0.1	176 31
49	9	6	12	NA	20 2.6	4.0 0.4	1.3 0.3	2.1 0.3	1.1 0.3	179 30
50	9	6	8	5.3 0.7	34 11.7	3.6 0.6	1.6 0.2	2.7 0.8	1.3 0.1	204 22
51	10	5	31	3.4 0.8	17 3.2	3.5 0.6	1.3 0.2	1.7 0.5	0.8 0.3	144 26
52	3	6	2	4.0 1.0	15 10.6	4.9 NA	1.6 NA	1.8 0.5	0.9 0.2	125 30
53	4	5	29	3.8 0.3	17 1.0	3.1 0.3	1.4 0.2	2.6 0.3	0.7 0.1	150 5

54	8	5	31	4.1	0.3	20	3.4	3.2	0.4	1.3	0.3	2.1	0.4	1.0	0.1	199	151
55	6	6	6	4.3	0.5	13	NA	4.8	NA	1.4	NA	2.2	NA	1.0	NA	159	26
56	7	6	2	4.0	0.8	26	8.3	3.3	1.2	1.2	0.2	2.3	0.2	1.1	0.1	215	29
57	9	6	10	3.9	0.4	20	3.1	3.2	0.5	1.2	0.2	2.0	0.6	0.9	0.1	175	19
58	7	6	14	3.3	0.9	18	3.3	3.8	0.5	1.3	0.3	2.2	0.4	0.8	0.2	209	18
59	6	6	13	5.0	0.7	24	10.6	3.7	0.7	1.4	0.1	2.4	0.4	1.0	0.1	178	30
60	10	6	6	3.9	0.5	20	3.5	3.7	0.8	1.3	0.2	2.2	0.3	1.1	0.2	182	28
61	9	6	13	4.6	0.4	28	7.6	3.9	0.6	1.3	0.2	2.2	0.3	1.1	0.2	200	32
62	6	6	10	3.3	0.3	17	3.5	3.1	0.4	1.6	0.4	2.1	0.5	0.8	0.1	183	19
63	10	6	6	3.8	0.4	18	3.9	3.3	0.7	1.2	0.2	1.8	0.3	1.0	0.1	183	31
64	1	6	5	4.0	NA	11	NA	3.4	NA	0.8	NA	1.5	NA	0.7	NA	113	NA
65	10	6	8	4.5	0.8	21	4.9	3.9	0.9	1.2	0.3	2.2	0.5	1.1	0.2	190	25
66	8	6	1	3.6	1.6	25	8.5	3.8	0.8	1.1	0.4	2.5	0.8	0.8	0.1	163	40
67	10	6	7	3.4	0.5	17	4.8	3.0	0.6	0.8	0.3	2.2	0.1	0.9	0.2	200	15
68	9	6	12	4.8	0.5	26	5.2	4.2	0.7	1.7	0.4	3.0	0.7	1.3	0.3	206	19
69	10	6	10	4.8	0.4	27	4.1	3.7	0.3	1.5	0.6	2.6	0.4	1.1	0.2	199	23
70	9	6	10	4.7	0.4	25	3.6	3.4	0.5	1.3	0.3	2.3	0.5	1.1	0.2	218	18
71	9	6	12	4.4	0.5	25	5.0	3.5	0.6	1.1	0.4	2.6	0.5	1.2	0.2	217	21
72	10	6	12	4.7	0.6	27	3.3	2.9	0.4	1.1	0.2	2.3	0.2	1.0	0.2	209	30
73	8	6	10	3.1	0.6	19	3.5	3.1	0.7	1.1	0.3	2.1	0.4	0.8	0.2	146	24
74	4	6	15	3.6	0.5	21	NA	2.9	1.8	1.0	0.4	2.6	0.6	0.8	NA	175	30
75	10	6	9	3.6	0.9	20	5.0	3.4	0.8	1.2	0.3	2.1	0.4	0.9	0.2	148	48
76	10	6	7	4.1	0.6	21	1.4	3.7	0.9	1.3	0.3	2.1	0.3	1.1	0.3	195	27
77	8	6	18	5.0	2.1	27	5.5	4.4	1.1	1.5	0.2	2.8	1.2	1.4	NA	226	29
78	9	6	8	4.7	0.8	21	NA	3.1	0.2	1.3	0.5	2.0	NA	1.3	0.4	223	21
79	9	6	11	4.5	NA	20	NA	4.2	NA	1.2	NA	2.0	NA	1.4	NA	186	40
80	10	6	9	4.4	0.5	21	2.3	3.9	0.7	1.3	0.3	1.8	0.5	1.0	0.2	224	33
81	7	6	7	4.1	0.2	20	2.3	4.1	0.6	1.5	0.4	2.2	0.2	1.1	0.2	241	31
82	10	6	7	3.9	0.5	21	0.5	4.0	0.5	1.3	0.3	2.2	0.5	1.0	0.1	211	42
83	10	6	8	4.0	0.4	24	11.2	3.8	0.6	1.2	0.3	2.4	0.4	1.0	0.2	202	38

Table 2. Number of plants measured in each accession, date of anthesis, head diameter at maturity, ray number, ray length, ray width, phyllary length, phyllary width of the primary capitulum, and length of the primary stem of the first 246 accessions in the USDA Helianthus annuus L. collection at Davis, Calif.--Continued

HSP07 No.	No. Plts	Anthesis		Primary Head Diameter		Rays Number		Rays Length		Rays Width		Phyllaries Length		Phyllaries Width		Stem Length	
		Mo	Day	cm1				cm1		cm1		cm1		cm1		cm1	
84	10	6	9	4.1	0.3	20	2.5	4.0	0.4	1.2	0.2	2.4	0.3	1.1	0.3	176	36
86	9	6	14	3.5	0.6	19	3.9	3.4	0.8	1.4	0.2	2.0	0.4	0.7	0.2	199	16
87	9	6	6	3.9	0.6	24	6.0	2.9	0.3	1.3	0.2	1.8	0.5	1.0	0.1	173	28
88	8	6	8	3.8	0.6	19	2.0	3.3	0.8	1.3	0.2	1.9	0.2	0.8	0.1	150	36
89	10	6	13	3.9	0.9	28	21.1	4.2	1.6	1.3	0.5	2.0	0.7	0.9	0.1	189	23
90	8	6	13	4.3	0.5	18	3.5	4.3	1.0	1.9	0.7	2.4	0.3	1.0	0.2	180	21
91	9	6	10	3.8	0.5	24	6.7	3.7	0.9	1.4	0.2	1.8	0.5	0.9	0.1	181	31
92	9	6	3	3.7	0.5	20	2.0	3.3	0.7	1.2	0.3	2.1	0.4	0.8	0.1	174	24
93	10	6	3	3.6	0.5	18	2.5	3.0	0.8	1.0	0.3	2.2	0.3	0.8	0.2	198	24
94	10	6	6	4.0	0.4	23	3.7	3.2	0.8	1.2	0.3	2.3	0.5	1.0	0.2	204	26
95	10	5	31	4.1	0.6	21	4.6	3.3	0.6	1.1	0.2	2.4	0.1	1.1	0.4	205	14
96	10	6	3	3.5	0.5	28	21.7	3.4	0.8	1.1	0.3	2.1	0.5	0.8	0.2	176	18
97	4	6	4	NA		18	NA	2.9	NA	1.1	NA	2.0	NA	0.9	NA	151	45
98	9	6	9	4.3	0.6	18	4.2	3.3	0.9	1.4	0.3	1.7	0.6	1.0	0.2	182	40
99	10	6	11	4.3	0.9	19	4.9	3.7	0.4	1.4	0.2	2.3	0.7	1.1	0.3	182	18
100	8	6	9	3.9	0.5	19	1.0	3.7	0.4	1.4	0.2	2.2	0.6	1.1	0.2	167	12
101	10	6	6	4.1	0.6	18	4.2	3.8	0.1	1.5	0.4	2.5	NA	1.0	0.1	200	29
102	10	6	8	3.9	1.0	18	5.0	3.0	0.4	1.2	0.3	2.0	0.5	1.0	0.2	173	18
103	10	6	11	3.6	0.8	18	3.4	3.0	0.5	1.3	0.3	2.0	0.3	1.1	0.4	174	17
104	8	6	4	3.9	0.5	23	NA	3.2	NA	1.2	NA	2.8	NA	0.9	NA	174	21
105	8	6	10	3.8	0.6	18	2.8	3.3	0.9	1.4	0.3	2.0	0.4	0.9	0.2	164	24
106	7	6	9	3.6	1.4	24	5.6	3.6	0.7	1.4	0.4	2.8	0.7	1.1	0.3	184	29
107	9	6	8	3.3	0.3	16	4.2	3.4	0.5	1.3	0.2	1.7	0.3	0.9	0.1	135	21
108	10	6	3	3.2	0.5	17	2.6	2.6	0.4	1.0	0.2	1.8	0.2	0.9	0.1	143	23
109	10	5	29	3.2	0.4	16	2.7	3.0	0.4	1.1	0.2	1.7	0.2	0.8	0.1	130	17
110	9	6	6	3.6	0.6	20	4.2	3.3	0.8	1.3	0.3	2.2	0.3	0.9	0.1	168	29

111	10	6	3	3.7	0.6	22	6.9	3.6	0.8	1.3	0.3	1.9	0.4	1.1	0.2	184	31
112	10	6	6	5.0	NA	27	9.3	4.0	0.7	1.7	0.3	3.4	0.5	1.2	0.3	193	20
113	10	6	3	5.4	1.3	38	4.7	4.0	0.9	1.4	0.3	3.1	0.7	1.3	0.4	174	25
114	10	5	29	5.4	1.4	25	10.9	4.5	0.6	1.3	0.2	2.9	1.0	1.3	0.4	155	51
115	10	5	26	5.4	1.2	25	6.5	4.3	0.9	1.5	0.3	3.5	0.8	1.4	0.5	153	53
116	9	6	8	6.8	1.0	35	6.1	4.2	0.6	1.3	0.3	3.1	0.8	1.3	0.2	208	28
117	10	6	9	7.3	1.2	39	6.6	4.1	1.2	1.7	0.5	3.6	0.6	1.6	0.3	177	29
118	10	6	14	5.5	0.4	32	7.0	4.0	0.5	1.5	0.3	3.0	0.6	1.3	0.4	216	21
119	10	6	8	5.6	2.0	32	4.9	4.0	0.4	1.3	0.3	3.7	NA	1.7	0.3	185	19
120	8	6	8	6.6	1.3	27	4.2	3.8	0.1	1.4	0.1	3.4	NA	1.3	0.1	189	33
121	9	6	11	6.4	1.8	32	9.4	4.4	0.8	1.7	0.4	3.5	1.1	1.8	0.5	183	32
122	10	6	4	5.7	0.4	35	8.8	4.3	0.5	1.5	0.2	3.2	0.7	1.4	0.2	199	25
123	8	6	9	5.4	1.7	35	8.5	4.0	0.7	1.4	0.3	3.0	0.9	1.5	0.5	303	251
124	10	6	7	7.1	1.8	43	11.3	4.3	1.0	1.5	0.3	3.9	1.1	2.0	1.1	251	173
125	9	6	11	3.6	0.5	20	2.5	3.0	0.5	1.1	0.2	2.1	0.5	0.8	0.2	168	27
126	10	6	10	4.3	0.6	22	1.7	3.2	0.2	1.1	0.2	2.3	0.7	1.1	0.2	165	21
127	10	6	11	4.4	0.6	19	3.3	3.4	0.5	1.2	0.2	2.6	0.7	1.1	0.3	191	18
128	9	6	9	4.7	0.4	25	4.9	3.4	0.5	1.4	0.3	2.3	0.4	1.1	0.2	204	17
129	10	6	13	5.0	0.9	28	5.1	4.1	1.1	1.3	0.3	2.6	0.5	1.0	0.2	209	32
130	10	6	10	4.3	0.4	20	4.9	3.6	0.4	1.3	0.3	2.2	0.5	0.9	0.1	206	31
131	10	6	10	4.8	0.6	26	7.1	3.8	0.9	1.3	0.3	2.5	0.6	1.0	0.2	205	34
132	10	6	10	5.1	1.5	22	2.3	4.0	0.4	1.7	0.3	2.2	0.5	1.3	0.3	224	19
133	10	6	8	4.3	0.8	22	2.9	3.9	0.6	1.5	0.2	2.9	0.9	1.3	0.4	207	34
134	10	6	14	4.5	0.4	22	2.7	3.6	0.8	1.1	0.3	2.2	0.5	1.0	0.2	222	29
135	10	6	10	3.6	0.2	17	2.2	3.7	0.4	1.1	0.1	2.1	0.2	1.0	0.1	176	23
136	10	6	6	3.9	0.4	18	3.0	3.6	0.5	1.2	0.2	2.1	0.7	0.9	0.1	181	19
137	10	5	31	3.7	0.4	20	3.3	3.6	0.7	1.5	0.3	2.2	0.3	1.1	0.2	167	20
138	9	6	1	3.9	0.4	23	4.9	3.5	0.4	1.2	0.3	2.1	0.3	0.9	0.1	179	24
139	1	5	18	NA		18	NA	3.7	NA	1.5	NA	1.3	NA	0.7	NA	97	NA
141	5	6	2	3.4	0.5	17	NA	3.7	NA	1.3	NA	1.8	NA	0.9	NA	118	22

Table 2. Number of plants measured in each accession, date of anthesis, head diameter at maturity, ray number, ray length, ray width, phyllary length, phyllary width of the primary capitulum, and length of the primary stem of the first 246 accessions in the USDA Helianthus annuus L. collection at Davis, Calif.--Continued

HSF07 No.		Anthesis		Primary Head Diameter		Rays Number		Rays Length		Rays Width		Phyllaries Length		Phyllaries Width		Stem Length	
No.	Plts	Mo	Day	cm1				cm1		cm1		cm1		cm1		cm1	
142	9	6	17	3.6	0.2	22	0.7	3.7	0.1	1.2	0.3	2.8	1.2	1.0	0.3	188	27
143	5	6	6	3.5	0.7	NA		NA		NA		1.9	NA	1.0	NA	140	18
144	10	6	11	3.9	0.5	20	3.3	3.6	0.8	0.9	0.2	2.3	0.6	0.8	0.2	192	33
145	10	6	11	3.9	0.4	21	4.7	3.5	0.5	1.2	0.2	2.5	0.5	1.1	0.2	185	27
146	10	6	8	4.0	NA	21	2.4	3.2	0.5	1.0	0.2	2.0	0.3	0.9	0.1	165	26
148	10	6	8	3.8	1.0	20	4.3	3.6	0.7	1.0	0.2	2.2	0.5	1.1	0.1	171	27
149	10	6	13	4.1	0.7	23	2.9	3.4	0.5	1.3	0.3	2.0	0.4	1.1	0.1	191	20
150	10	6	9	4.4	0.6	30	5.1	4.0	0.5	1.1	0.4	2.5	0.6	1.0	0.2	183	30
151	4	6	2	3.3	1.2	21	6.2	2.7	0.2	1.1	0.1	2.0	0.5	2.6	3.3	123	15
152	3	6	6	3.5	0.7	NA		NA		NA		2.0	NA	0.8	NA	153	35
153	10	6	14	3.8	0.5	24	2.7	2.7	0.5	0.8	0.2	1.9	0.2	0.9	0.1	185	28
154	10	6	9	4.4	0.8	23	3.9	3.5	0.4	1.2	0.2	1.9	0.5	0.9	0.2	193	19
155	9	6	13	3.4	0.4	20	1.6	3.4	0.6	1.0	0.2	1.9	0.3	1.0	0.1	181	34
156	10	6	6	3.5	0.3	18	4.8	3.0	0.5	1.0	0.1	2.0	0.3	1.0	0.2	159	17
157	10	5	31	3.1	0.7	16	2.8	2.2	1.1	0.9	0.2	1.5	0.1	1.0	0.2	116	18
158	9	6	10	2.9	0.2	15	1.7	2.3	0.5	0.9	0.1	1.6	0.4	0.6	NA	123	17
159	9	6	10	3.3	0.9	15	4.6	3.0	0.4	1.0	0.2	1.6	0.1	0.8	0.1	138	21
160	1	6	16	4.5	NA	19	NA	4.9	NA	1.5	NA	1.9	NA	0.9	NA	220	NA
161	9	6	12	3.0	0.4	15	2.3	2.5	0.3	1.0	0.1	1.5	0.3	0.7	0.1	188	17
162	4	8	10	NA		39	6.2	4.0	0.4	1.0	0.2	3.1	0.3	1.1	0.1	164	NA
163	2	6	10	4.8	0.4	NA		NA		NA		NA		NA		191	NA
164	6	6	15	NA		27	NA	4.4	NA	1.3	NA	1.9	NA	1.2	NA	197	33
165	9	6	4	3.5	0.3	15	3.4	2.6	0.6	1.1	0.2	3.0	0.4	0.9	0.1	165	44
166	1	6	6	4.0	NA	16	NA	2.9	NA	0.9	NA	2.1	NA	1.2	NA	193	NA
167	10	6	6	3.9	0.5	23	3.2	4.2	0.7	1.3	0.2	2.1	0.2	1.1	0.2	186	14
168	9	6	3	4.1	0.5	19	1.9	3.3	0.8	1.3	0.3	2.2	0.5	1.1	0.2	157	22
169	8	6	9	4.6	0.2	25	7.1	3.6	0.4	1.1	NA	2.6	0.3	1.0	0.2	177	26

170	8	6	13	4.2	0.6	34	18.3	3.2	0.4	1.1	0.2	2.1	0.3	1.1	0.2	194	25
171	9	6	6	3.5	0.3	21	3.9	2.7	0.7	0.9	0.3	2.0	0.2	0.9	0.1	174	26
172	5	6	9	4.7	0.8	26	5.6	3.7	0.8	1.3	0.2	2.5	0.4	1.1	0.1	147	41
173	7	6	6	4.6	0.6	24	7.9	3.4	0.5	1.4	0.3	2.9	0.7	1.0	0.1	156	22
174	6	6	7	3.5	1.1	15	4.6	2.8	0.7	0.9	0.3	1.4	0.4	0.7	0.1	106	16
175	10	5	31	2.9	0.5	16	2.7	2.7	0.8	1.1	0.4	2.0	0.3	0.7	0.1	125	27
177	1	5	28	4.0	NA	20	NA	4.5	NA	1.4	NA	1.7	NA	1.6	NA	117	NA
178	8	6	2	4.0	0.3	20	1.8	3.5	0.6	1.2	0.2	1.9	0.2	1.0	0.1	134	31
179	10	6	9	4.0	0.4	20	2.3	3.8	0.9	1.4	0.6	1.5	0.3	1.1	0.1	183	23
180	7	6	9	4.0	0.7	25	5.0	3.7	0.2	1.0	0.1	2.4	0.4	1.0	0.3	195	9
181	2	6	4	NA		16	NA	2.8	NA	1.0	NA	2.6	NA	1.0	NA	200	28
182	8	6	18	4.0	NA	21	NA	3.1	NA	1.0	NA	1.4	NA	1.3	NA	215	22
183	8	6	5	3.8	0.5	24	5.7	3.4	0.8	1.1	0.3	2.4	0.4	1.0	0.2	164	21
184	10	6	9	3.5	0.8	18	2.5	2.9	0.3	1.0	0.2	2.0	0.4	0.8	0.2	193	26
185	6	6	9	3.7	0.6	18	3.4	3.5	1.0	1.3	0.4	2.2	0.7	1.0	0.2	197	31
187	6	6	16	4.0	0.6	20	3.3	3.5	0.6	1.4	0.1	2.9	0.7	1.2	0.1	229	13
188	9	6	7	3.4	0.7	15	5.2	3.5	0.9	1.2	0.3	2.1	0.3	1.0	0.3	198	31
189	8	6	4	3.8	0.3	22	7.4	3.8	1.3	1.3	0.4	1.9	0.7	1.0	0.3	189	27
190	9	6	2	4.3	0.8	23	6.3	3.5	0.7	1.2	0.2	2.4	0.5	1.1	0.1	185	26
191	10	6	5	3.9	0.6	25	5.2	3.8	0.4	1.2	0.1	2.0	0.5	1.1	0.2	187	18
192	8	6	11	3.8	0.8	22	2.1	3.2	0.7	1.0	0.3	2.3	0.4	1.0	0.2	210	22
193	9	6	10	4.1	0.2	24	4.3	3.3	0.7	1.3	0.3	2.1	0.7	1.0	0.1	170	13
195	10	6	9	3.9	0.4	20	1.1	3.5	0.5	1.1	0.2	2.2	0.5	1.0	0.1	170	18
196	10	5	30	2.6	0.8	21	3.7	3.0	0.3	1.0	0.2	2.1	0.6	0.9	0.1	165	20
197	10	5	31	3.1	0.5	19	1.5	1.9	0.6	0.7	0.3	1.8	0.4	0.9	0.1	174	16
198	10	6	16	4.1	0.5	21	3.6	3.8	1.1	1.1	0.2	2.2	0.3	1.2	0.3	206	28
199	10	6	4	3.8	0.4	19	2.5	3.5	1.0	1.3	0.3	2.1	0.3	1.0	0.1	197	37
200	9	6	11	3.8	0.4	19	3.2	3.4	0.6	1.3	0.2	2.1	0.4	0.9	0.2	196	31
201	9	6	14	3.4	0.7	23	5.5	3.5	0.8	1.0	0.2	2.1	0.2	1.0	0.1	190	31
202	10	6	6	3.8	0.3	19	3.6	2.7	0.3	1.1	0.2	2.4	0.3	1.0	0.2	152	22

Table 2. Number of plants measured in each accession, date of anthesis, head diameter at maturity, ray number, ray length, ray width, phyllary length, phyllary width of the primary capitulum, and length of the primary stem of the first 246 accessions in the USDA Helianthus annuus L. collection at Davis, Calif.--Continued

HSF07 No.		Primary Anthesis		Head Diameter		Rays Number		Rays Length		Rays Width		Phyllaries Length		Phyllaries Width		Stem Length	
No.	Plts	Mo	Day	cm]				cm]		cm]		cm]		cm]		cm]	
203	10	6	3	3.4	0.7	21	4.4	3.3	0.6	1.1	0.3	1.9	0.5	0.8	0.1	184	13
204	9	6	5	3.0	0.4	19	2.8	2.5	0.6	0.9	0.2	1.9	0.4	0.8	0.1	162	25
205	6	6	11	3.5	NA	18	NA	3.2	NA	1.0	NA	2.3	NA	1.1	NA	188	8
206	9	6	8	2.6	0.6	17	3.1	2.1	0.6	0.9	0.2	1.7	0.4	0.9	0.1	154	29
207	9	6	4	3.5	0.3	20	5.1	2.9	0.6	0.9	0.1	2.5	0.6	0.8	0.1	244	232
208	9	6	7	3.7	0.4	25	6.5	3.6	0.6	1.0	0.2	1.8	0.3	0.8	0.2	181	25
209	8	6	12	3.7	0.3	20	2.1	2.8	0.2	1.0	0.2	2.3	0.5	1.0	0.3	179	33
210	7	6	10	2.6	0.5	21	7.0	2.3	0.4	0.8	0.1	2.1	0.2	0.9	0.1	182	36
211	10	6	10	2.8	0.3	20	1.7	3.0	0.5	1.1	0.2	1.8	0.5	0.9	0.2	164	18
212	8	6	11	3.4	0.3	21	2.2	3.4	0.6	1.1	0.2	1.8	0.3	0.8	0.1	159	11
213	10	6	4	3.6	0.4	19	2.8	3.4	0.6	1.2	0.2	2.0	0.4	1.0	0.1	176	17
214	10	6	10	3.9	2.0	24	4.3	4.0	0.6	1.0	0.2	1.7	0.4	0.8	0.1	169	21
215	9	6	6	3.5	0.4	21	5.9	3.3	0.5	1.1	0.3	2.1	0.5	0.8	0.1	166	26
216	9	6	11	3.5	0.4	19	1.9	3.4	0.6	1.3	0.3	2.4	0.3	1.0	0.1	169	20
217	9	6	3	3.5	0.5	18	3.2	3.3	0.5	1.5	0.4	1.7	0.4	1.1	0.1	146	36
218	9	6	6	3.4	0.4	19	4.3	3.7	0.4	1.2	0.2	2.6	0.7	1.0	0.1	167	30
219	8	6	7	3.7	0.3	20	1.5	3.6	0.4	1.3	0.1	2.2	0.4	1.0	0.2	177	23
220	3	6	7	2.7	0.3	21	2.5	2.5	0.8	0.7	0.2	1.7	0.5	0.6	NA	122	9
221	9	6	6	3.0	0.6	20	4.7	2.7	0.6	0.8	0.2	1.4	0.3	0.7	0.1	128	21
222	10	6	7	2.8	0.3	13	1.1	3.0	0.6	0.9	0.3	1.9	0.2	0.7	0.3	147	28
223	4	6	16	3.0	NA	15	NA	3.6	NA	0.7	NA	1.6	NA	0.8	NA	180	32
224	10	5	23	4.6	0.7	23	5.4	3.8	0.8	1.3	0.3	2.6	0.5	1.0	0.2	132	26
225	10	5	24	4.1	0.6	21	4.0	3.0	0.9	1.1	0.3	2.2	0.4	1.1	0.1	128	15
226	6	6	8	3.6	0.4	17	1.7	3.1	0.4	1.0	0.1	1.9	0.5	0.9	0.2	117	10
227	9	5	23	4.3	1.5	26	7.7	3.6	0.9	1.2	0.3	2.8	0.8	1.1	0.4	117	41
228	10	5	20	3.9	1.3	25	10.2	2.9	0.4	1.1	0.2	2.3	0.4	1.0	0.2	104	39

229	10	5	30	3.5	0.5	16	3.2	2.8	1.1	1.0	0.2	2.4	0.3	0.9	0.2	154	21
230	10	5	31	3.7	0.4	20	5.7	2.9	0.7	0.9	0.2	2.1	0.4	1.1	0.2	132	34
231	2	6	7	3.0	NA	20	NA	1.5	0.1	0.6	0.1	1.9	1.1	0.8	NA	82	10
232	10	5	29	2.1	0.6	12	2.6	1.5	0.3	0.8	0.1	2.6	0.8	0.8	0.3	53	9
233	10	6	2	3.5	1.0	21	6.3	3.1	0.6	1.2	0.3	2.2	0.5	1.0	0.1	127	17
234	6	6	12	4.3	0.5	20	2.2	3.6	0.3	1.2	0.3	2.0	0.3	1.0	0.1	204	17
235	10	6	15	3.4	0.2	19	2.6	3.2	0.5	1.1	0.2	2.3	0.6	0.9	0.2	161	22
236	10	6	14	1.8	0.4	12	1.1	1.8	0.2	0.8	0.1	2.1	0.4	0.5	0.1	81	10
237	8	6	19	3.8	0.4	24	3.2	2.8	0.7	0.8	0.2	1.8	0.2	0.9	0.1	164	19
238	8	6	11	3.2	0.3	17	3.3	3.0	0.5	1.2	0.1	2.0	0.5	1.1	0.1	159	23
239	10	6	6	3.3	0.4	18	3.6	3.3	0.5	1.0	0.1	2.0	0.4	1.0	0.1	180	10
240	9	6	8	4.3	0.3	23	6.2	3.3	1.0	1.2	0.3	1.8	0.4	0.9	0.1	157	18
241	10	6	12	3.6	0.4	20	2.6	3.2	0.4	1.1	0.3	2.1	0.4	1.0	0.1	172	19
242	5	6	5	5.9	0.9	29	4.6	3.8	0.7	1.6	0.3	2.5	0.4	1.3	0.2	130	13
243	10	6	3	5.2	0.5	30	5.2	3.4	0.6	1.3	0.2	2.1	0.6	1.1	0.2	157	20
244	10	6	2	5.3	0.3	32	2.9	3.9	0.7	1.5	0.4	2.5	0.5	1.2	0.1	172	32
245	6	6	17	3.5	0.4	18	3.0	3.2	0.9	1.0	0.1	1.9	0.5	0.9	0.2	157	26
246	10	6	5	3.7	0.3	18	3.8	3.1	0.4	1.3	0.3	1.8	0.2	0.8	0.1	144	22

1. Numbers given are means plus or minus the standard deviation

Note: NA =not available.

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